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Utah Forest Insect and Disease Conditions Report 2015

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Utah Forest Insect and Disease Conditions Report 2015

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and
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FOREST HEALTH CONDITIONS SUMMARY

This report focuses only on the impacts of insects, diseases, and other disturbances on the various tree species in the state. Aerial detection surveys (ADS) conducted by the USDA Forest Service, Forest Health Protection offices are the means of collecting data that is used to describe mortality trends in the state from year to year. Mortality trends are described in terms of acres affected, however, not all trees on these acres are dead. Thus, an estimate of the number of trees killed is also provided. Not all forested lands are surveyed, and not all the same acres are surveyed every year. The number of acres flown/surveyed in each county in 2015 is provided in Table 1. Figure 1 shows areas that were surveyed. Over twelve million acres were flown and most was on National Forest Service (NFS), Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), and National Park Service (NPS) lands, in addition to state, and private lands. Long-term insect trend data summarizes activity detected on all surveyed ownerships in Utah.

Forests throughout much of Utah are composed of dense stands that are relatively uniform in age, composition, and structure resulting in poor forest health conditions. Unhealthy forests are conducive to insect and disease issues. In other words, insect and disease issues are not the cause of poor forest health, but are the result. Several factors can contribute to the decline in forest health, including; lack of active management, poor grazing patterns, fire exclusion, and invasive weeds. Adequate precipitation and growing space is necessary to maintain tree vigor, thereby increasing tree resistance to insects and diseases. Drought conditions throughout the State continue to place more stress on forests that are already in poor health.

Table 2 shows the number of trees killed and acres affected by bark beetles in Utah counties as detected by ADS in 2015. Table 3 shows the number of acres impacted by defoliators & other agents in Utah counties. In general, insect and disease-caused tree mortality increased from 2014.

Overall, mountain pine beetle in lodgepole pine decreased by 69% from 2014 going from 22,395 acres affected to 7,621 acres. However, the number of trees killed more than doubled in limber pine (3,213 in 2014; to 7,818 in 2015).

Spruce beetle-caused tree mortality increased from 2014. In 2015, the number of trees killed statewide was 696,043, an increase of just over 25% from 2014 (555,435 trees killed)., Most mortality occurred in Summit, Duchesne, and Sevier Counties. The exception was Wasatch County where spruce mortality caused by this insect decreased.

In general, Douglas-fir beetle-caused tree mortality decreased by 45%.However, mortality still occurred statewide, with 4,562 acres affected.

White fir mortality caused by fir engraver decreased by 75% statewide; with 3,260 acres affected in 2015 from 10,519 acres in 2014.

Subalpine fir mortality caused by a complex of insect and disease agents increased slightly (8%) with a total of 25,005 acres affected in 2015, and was mapped in nearly all counties statewide.

Western spruce budworm defoliation totaled 67,016 acres affected in 2015; an increase of 42% from 2014.

Table 1. Total number of acres aerially surveyed in each county during 2015.

Aerial Detection Survey 2015		
County	Acres	% of County
Beaver	174,436	10.3
Box Elder	224,657	5.2
Cache	523,595	68.3
Carbon	93,108	9.4
Daggett	277,057	61.2
Davis	61,311	15.0
Duchesne	1,104,507	53.1
Emery	333,142	11.8
Garfield	1,491,816	44.7
Grand	137,405	5.9
Iron	512,001	24.3
Juab	254,978	11.5
Kane	297,288	11.4
Millard	419,796	9.7
Morgan	238,797	61.1
Piute	358,424	72.6
Rich	146,345	22.3
Salt Lake	145,822	28.7
San Juan	750,458	14.8
Sanpete	628,015	62.6
Sevier	933,153	75.7
Summit	715,664	59.5
Tooele	390,902	8.4
Uintah	373,211	12.9
Utah	707,641	51.0
Wasatch	597,427	76.6
Washington	537,074	35.0
Wayne	240,405	15.1
Weber	248,087	58.9
Total	**12,916,519**	23.8

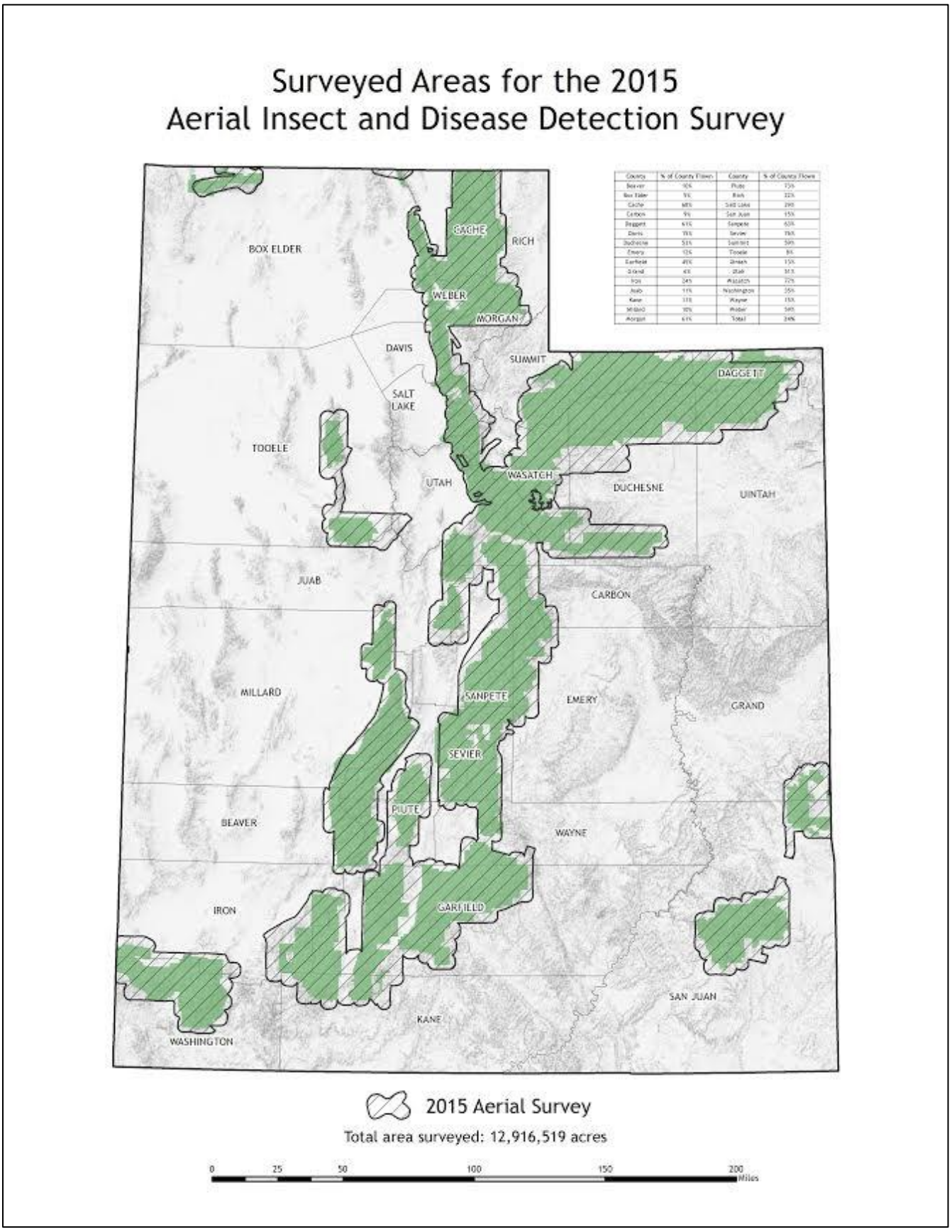

Figure 1. Surveyed Areas for the 2015 Aerial Insect and Disease Detection Survey

Table 2. Trees killed and acres affected by bark beetles in Utah counties as detected by ADS in 2015.

2015	Mountain Pine Beetle[1]		Douglas-fir Beetle		Spruce Beetle		Piñon Engraver		Fir Engraver Beetle		Subalpine Fir Mortality Complex	
COUNTY	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres
Beaver	579	255	60	30	590	260	22	11	240	120	194	97
Box Elder	0	0	315	158	7	3	2	1	0	0	571	257
Cache	895	307	265	132	99	49	30	15	0	0	6,349	2,810
Carbon	10	5	40	20	0	0	0	0	0	0	1,650	775
Daggett	120	32	80	40	182	182	0	0	0	0	3,831	1,737
Davis	0	0	0	0	0	0	0	0	0	0	10	5
Duchesne	2,700	1,316	174	87	234,038	40,418	21	12	17	8	1,997	572
Emery	2,001	908	103	51	7	3	0	0	0	0	1,815	793
Garfield	1	1	167	84	54	27	85	42	179	88	389	251
Grand	0	0	120	38	45	22	10	5	10	5	80	40
Iron	0	0	5	3	0	0	136	68	579	97	241	120
Juab	10	5	581	290	105	52	20	10	128	64	75	37
Kane	10	5	262	162	0	0	0	0	646	278	0	0
Millard	7	3	2,295	399	54	27	30	15	2,422	741	306	130
Morgan	0	0	120	60	0	0	0	0	55	27	615	307
Piute	526	259	202	101	13,536	1,861	112	56	179	75	646	318
Rich	655	175	60	30	92	46	0	0	0	0	988	366
Salt Lake	25	13	0	0	45	22	0	0	60	30	815	408
San Juan	0	0	609	304	59	29	8	5	834	388	1,202	898
Sanpete	2,141	1,041	874	392	0	0	8	4	0	0	4,208	1,892
Sevier	695	345	2,408	539	109,031	12,594	139	69	1,494	591	6,019	1,869
Summit	8,487	2,774	383	191	322,129	44,034	0	0	65	32	7,902	2,688
Tooele	0	0	320	160	0	0	34	17	158	79	130	65
Uintah	37	11	200	100	1,111	561	0	0	3	1	1,411	604
Utah	56	28	1,371	678	65	32	23	11	522	284	5,482	2,185
Wasatch	268	134	648	377	9,017	3,108	0	0	1,039	317	13,523	5,381
Washington	2	1	9	5	0	0	55	28	36	18	75	45
Wayne	0	0	208	51	5,761	1,309	10	5	0	0	5	2
Weber	5	2	165	81	16	8	0	0	30	15	715	353
Total	**19,230**	**7,621**	**12,044**	**4,562**	**696,043**	**104,650**	**745**	**374**	**8,696**	**3,260**	**61,244**	**25,005**

[1]Mountain pine beetle has killed several species of trees: mostly lodgepole; but also ponderosa, and limber pine throughout Utah

Table 3. Number of acres impacted by defoliators & other agents in Utah counties in 2015.

2015	Western Spruce Budworm	Unknown Aspen Defoliation	Aspen Decline
County	**Acres**	**Acres**	**Acres**
Beaver	17,622	0	0
Box Elder	0	0	0
Cache	4,503	0	421
Carbon	134	0	55
Daggett	542	61	660
Davis	0	0	0
Duchesne	0	0	3,164
Emery	0	0	20
Garfield	8,442	545	2,887
Grand	2,566	0	145
Iron	1,982	0	2,628
Juab	0	0	19
Kane	96	0	410
Millard	0	0	196
Morgan	0	0	21
Piute	14,911	0	556
Rich	2,290	0	101
Salt Lake	0	0	0
San Juan	1,728	38	1,109
Sanpete	0	0	113
Sevier	6,358	571	7,502
Summit	0	55	24
Tooele	0	0	0
Uintah	0	305	2,843
Utah	0	0	865
Wasatch	297	267	2,272
Washington	0	0	15
Wayne	5,545	0	204
Weber	0	0	0
Total	**67,016**	**1,842**	**26,230**

INSECT STATUS NATIVE DEFOLIATORS

Douglas-fir Tussock Moth

Orgyia pseudotsugata McDunnough

Hosts: all true firs, Douglas-fir, and spruce

The Douglas-fir tussock moth (DFTM) is an important native insect capable of causing extensive defoliation. Caterpillars feed on the needles of trees which can lead to topkill and after several seasons of defoliation, tree mortality. Outbreaks are cyclical due to natural controls, such as parasitic wasps, a virus, and weather conditions. The hairs on caterpillars can cause allergic reactions in some individuals.

No DFTM defoliation was detected in Utah in 2015

Figure 2. Douglas-fir tussock moth larvae (Photo: D. McComb, Bugwood.org).

Western Spruce Budworm

Choristoneura freemani Freeman

Hosts: Douglas-fir, subalpine fir, white fir, blue spruce, and Engelmann spruce

Western spruce budworm (WSBW) is the most widely distributed and destructive defoliator of coniferous forests in western North America. Trees may be extensively defoliated during outbreaks, resulting in stress that can directly kill the tree or make it susceptible to diseases and secondary insect pests, such as the Douglas-fir beetle.

Over the last few years, defoliation of subalpine fir, Douglas-fir, and Engelmann spruce has increased significantly in the high plateaus of Beaver, Cache, Rich, Piute, Garfield, Wayne, Grand, and San Juan counties.

Western spruce budworm defoliation increased by 42% in 2015. The most remarkable increase was in Cache and Rich counties; from none in 2014 to 4,503 and 2,290 acres respectfully in 2015. Most of this activity started in the Monte Cristo Range just north of Monte Cristo, near Pete's Hollow, and extended north to the Ogden Ranger District (ORD)/Logan Ranger District (LRD) boundary. On the LRD, Polygons up to 40 acres in size started in the Elk Valley area and ranged north along the eastern Forest boundary to the northern Forest Boundary. Some polygons were also mapped west of Logan Canyon ranging north to the Mt. Naomi Wilderness boundary.

There was a slight decrease of WSBW defoliation in Sevier and Iron counties. Interestingly, while the largest increase of WSBW defoliation in 2013 occurred in Sanpete County, (38 acres to 7,198 acres) no WSBW defoliation was mapped in Sanpete County in 2015.

Western Tent Caterpillar
Malacosoma californicum Packard

Hosts: aspen, willow, cherry, cottonwood, mountain mahogany, oak, alder, and birch

The first noticeable thing about western tent caterpillar (WTC) is white silken tents formed in branch crotches. Aspen is the preferred host, but WTC may attack a wide range of deciduous trees and shrubs. Outbreaks, usually last two to three years in the western states. Repeated defoliation and other stress factors may reduce growth rates of infested trees, kill trees, or predispose them to other diseases or insect pests. Larvae are dark brown with bluish heads, reddish-brown stripes, and distinct white, keyhole-shaped markings down their backs. Western tent caterpillars are often confused with fall webworms, which are rather hairy and reddish–brown in color. The fall webworm makes large diffuse webs that encase entire branches, often found on chokecherry and other deciduous trees and shrubs.

Western False Hemlock Looper
Nepytia freemani Munroe

Hosts: Douglas-fir, white fir, subalpine fir, and Engelmann spruce

Young inch worm (looper) larvae begin to feed on new foliage in the upper crowns of trees during late May, progressing to the older foliage when new foliage is depleted. Eggs are often laid on defoliated twigs and the resulting larvae may feed on the new needles causing twig mortality. In late summer the ground beneath heavily defoliated trees may be carpeted with partially eaten needles and frass. During outbreaks, trees may be entirely defoliated in one season.

Needle Insects

Piñon Needle Scale
Matsucoccus acalyptus Herbert

Hosts: Colorado and singleleaf piñon pine

The piñon needle scale is a native sap-sucking insect that feeds on older needles of piñon pine trees. Damage results in tip killing, branch flagging, stunted tree growth, and needle injury. Thin crowns cause a ghostly "see-through" appearance, with trees retaining only current year's needles. Insects in the first larval stage are hard to see on the needles but insects in the second larval stage resemble tiny black beans. Small trees may be killed outright and large trees may be seriously weakened after repeated infestations, rendering them susceptible to piñon engraver beetle. Most piñon seem to recover in a few years from light to moderate defoliation.

Black Pineleaf Scale

Nuculaspis californica Coleman

Figure 3. Black pineleaf scale on Austrian pine (Photo: C. Keyes; UT, DNR, FFSL).

Hosts: *Pinus spp.* especially Scotch/Scots and Austrian pines

The black pineleaf scale attacks several pine species and on rare occasions Douglas-fir and white fir. The insect generally overwinters as a partially developed scale. Eggs and immature nymphs (crawlers) appear in June or July, depending upon temperature. If there is a second generation, egg hatch and crawlers may appear again in late summer. Sap loss due to scale insect infestations may cause yellowing or wilting of needles, stunting of the needles, needle mortality, and defoliation. Defoliation often leaves the tree with just the new growth at the tips of the branches. Infested needles sometimes look dull and light green to yellow-gray in color. Heavy infestations over several years may lead to death of all, or portions of the tree. Black pineleaf scale outbreaks have been associated with stressful growing conditions of the host tree; caused by drought, soil compaction, root injury, overwatering, and other factors that affect plant health. Additional stress, associated with scale infestation, may result in other insects and/or diseases attacking the tree.

Since about 2008, black pineleaf scale populations increased throughout urban and rural areas and peaked in 2010/2011. Fortunately, black pine leaf scale appears to be in decline since 2012. However, many trees are still infested throughout the state.

Native Bark Beetles

Fir Engraver Beetle

Scolytus ventralis LeConte

Hosts: true firs

Fir engraver beetle (FEB) is a major pest of true firs throughout the West. It attacks trees of any size. Tree stress due to drought, disease, and defoliation may incite outbreaks that cause severe tree mortality. This insect is often associated with other forest pests such as Douglas-fir tussock moth, spruce budworm, bark beetles, woodborers, and annosus root disease.

Mortality due to FEB decreased from 10,519 acres in 2014, to 3,260 acres in 2015; a 69% decrease statewide. Millard County had the highest defoliation of 719 acres, followed by Sevier County with 591 acres.

Millard County:

- Filmore Ranger District: Numerous 20-tree pockets occurred throughout the host type in drainages from the upper ridgeline above Ebbs Spring Canyon south to Spring Branch Canyon. These pockets are associated with the Scipio Fire. Larger polygons from 100 to 500 acres in

size occurred on the east side of the main ridgeline in upper drainages from Newt's Canyon to North Fork Canyon in the central portion of the Pahvant Plateau. Two large infestations (50 trees) were detected in the vicinity of Catherine's Peak and another in the middle portion of Chokecherry Canyon on the west side of the range. In the Canyon Mountains, several 1 to 20 tree pockets were detected in the upper reaches of Eight-Mile Canyon. Two large polygons (200 acres) averaging three firs killed per acre were detected in John Williams Canyon.

Sevier County:

- Beaver Ranger District: The largest pockets of fir mortality were comprised of 20 to 50 trees and located in the upper reaches of Grassy Creek and Pole Canyon. Small pockets of fir mortality were concentrated in the upper reaches of Cove Creek and Marbletop on the northern end of the District, and also in the vicinity of Cottonwood Basin on the southeastern end of the District.

- Richfield Ranger District: Two small pockets (1 to 14 trees) were located in the vicinity of Milos Kitchen up Koosharem Creek.

Mountain Pine Beetle

Dendroctonus ponderosae Hopkins

Hosts: lodgepole, limber, bristlecone, and ponderosa pine.

Mountain pine beetle (MPB) can kill thousands of trees per year during outbreak conditions and millions of trees during extended epidemics in western forests. At endemic levels, MPB favors weakened, less vigorous trees, with adequate phloem thickness to complete its life cycle. During epidemics, beetles may also attack small diameter trees (≥4" diameter at breast height). Extensive mortality may alter large forest landscapes by converting pine ecosystems to grass and shrub landscapes for a period of 10-20 years. This conversion affects wildlife species, water yields and fuels

In 2015, general MPB induced mortality continued to decrease from 2014, by 35 percent. However, MPB induced mortality of limber pine increased by 52 percent. Most of which were concentrated in Duchesne County. Scattered pockets of limber pine mortality were detected throughout the Duchesne Ranger District, with concentrations in Right Fork and Left Fork Canyons.

In 2015, MPB–caused tree mortality in lodgepole pine declined significantly from 8,095 acres (2014) to 2473 acres. Most of the preferred, susceptible host trees have been killed where the outbreak has been occurring for many years. However, in Summit County the acres affected increased from 529 in 2014, to 2,608 in 2015. Much of the mortality occurred on the Mountain. View Ranger District, and was mapped along the boundary between NFS lands and the Wilderness Boundary, as well as around Kabell Ridge and south of Beaver Meadows Reservoir.

In 2015, compared to 2014; MPB-caused tree mortality in ponderosa pine decreased by 78% in Beaver County. However, MPB induced mortality increased by 205% in Sevier County, and 30% in Emery County. Several other counties had minor increases and decreases in mapped mortality between 2014 and 2015.

Douglas-fir Beetle

Dendroctonus pseudotsugae Hopkins

Host: Douglas-fir

Douglas-fir beetle (DFB) typically kills single and small groups of trees, but during outbreak conditions, pockets of 100 or more tree mortality centers are not uncommon. At endemic (low) levels, DFB favors stressed and damaged trees such as; broken or windfallen, wounded or fire–injured trees, and trees with root disease or defoliation. Beetle populations can build rapidly in newly-fallen trees and spread to adjacent healthy standing trees.

In 2015, DFB-caused tree mortality reduced statewide by 165% (11,559 acres affected in 2014, to 4,562 acres affected in 2015).Nearly every County, with the exception of Davis and Salt Lake counties had some damage. Decreases and increases were noted; the largest decrease occurred in Sanpete and Garfield counties, while only a few counties had moderate to small increases.

Spruce Beetle

Dendroctonus rufipennis Kirby

Hosts: Engelmann and rarely blue spruce

The spruce beetle (SB) is the most significant natural mortality agent of mature spruce. Endemic populations usually exist in weakened or windthrown trees, logging slash, and fresh stumps. Outbreaks typically occur when beetle populations build to high levels in concentrations of windthrown trees. Dispersing adults may infest standing live trees, initially preferring larger diameter trees. Much of the mature spruce, throughout the state, has been killed over the last 20 years. Spruce beetle caused mortality continues to impact mature spruce stands.

In 2014, the number of trees killed by the spruce beetle increased from 2013 by 34%, and the number of acres affected increased by 65%.

In 2015, SB--caused tree mortality increased again by about 20% from 2014. Most mortality was noted in Duchesne, Summit, Wasatch, Piute, Sevier, and Wayne counties. Acres affected may be on National Forest, private or State Trust Lands.

In 2015, more specifically;

- In Piute and Sevier counties: On the Fishlake NF. The largest outbreak areas were again observed on the Fishlake Hightop Plateau. Numerous pockets ranging from 20 to 1,000 acres in size occurred from Na Gah Flat, north to the upper reaches of Tasha Creek, the Sevenmile Cirques and Lost Creek. Spruce beetle-caused tree mortality escaladed significantly in stands surrounding Hilgard Mountain and Thousand Lake Mountain, and on the northern end of the Mytoge Mountains. Approximately 31,325 trees were killed on the northern end of the Sevier Plateau with the majority of mortality again occurring in stands in the upper reaches of Monroe Creek on Monroe Mountain extending south to Marysvale Peak.

- Wasatch, Duchesne, and Summit counties; On the Uinta Wasatch Cache and Ashley National Forests. Massive polygons, some hundreds of acres in size (containing up to 10 trees/acre killed), occupied most of the spruce type on the Heber/Kamas District and the western portion of the Evanston District. Polygons up to several hundred acres in size) continued to expand on the Blacks Fork Drainages on the Evanston District(Uinta-Wasatch Cache NF). The largest concentration of newer activity was on the West Fork of the Blacks Fork Drainage, and extended all the way from the Wilderness to the northern boundary of the Forest.

- The largest polygons on the Mountain View District were found in and near the Wilderness north of Red Castle and both east and west of Flat Top Mountain, but some small pockets (up to 20 trees killed) could be found near Bridger Lake and alongside the oil fields in the Henry Forks Drainage. The first mapped spruce beetle-caused mortality on the Vernal District (no mortality was mapped in 2014); occurred in the Browne Canyon (Ashley NF) area and on the northwest corner of the District near Whiterocks Lake. Aerial detection surveyors mapped polygons and 5-14 tree pockets of spruce mortality across the majority of the Roosevelt Ranger District. Spruce beetle-caused mortality increased on the northern portion of the Duchesne District. High densities of spruce mortality exist throughout the District now.

Piñon Engraver Beetle

Ips confusus LeConte

Hosts: Colorado and singleleaf piñon

Injured or stressed trees are preferred by piñon engraver beetles. Attacks by this insect girdle and eventually kill piñons. Piñon engravers produce multiple generations each year and consequently populations can build rapidly in slash and stressed green trees. Beetles can then spread into healthy stands. As with other bark beetle species, piñon engravers carry a wood staining fungus into the tree, which in combination with the feeding larva, kills the tree.

Historically, piñon pine was not aerially surveyed in Utah. Drought combined with increased piñon engraver populations contributed to considerable piñon pine mortality in 2001-2002. Piñon-juniper woodlands have subsequently been surveyed each year due to concerns over the loss of this valuable forest type.

In 2015, mortality decreased from 751 acres in 2014 to 374 acres. Most mortality was still mapped in Sevier and Piute counties. Pinyon mortality occurred in small (1 to 14 trees) scattered pockets concentrated in the vicinities of Sargent Mountain and in the foothills west of Marysvale in the northeastern corner of the Beaver Ranger District. Other pockets were scattered along the foothills from Gold Gulch to City Creek Canyon west of Junction.

Western Pine Beetle

Dendroctonus brevicomis LeConte

Host: ponderosa pine

Western pine beetle can kill ponderosa pine from six inches in diameter at breast height or larger. This beetle usually targets weakened trees with reduced defenses. Such trees may be crowded in dense, overstocked stands; slow-growing, older ponderosa pine trees; or trees damaged by fire or lightning. When large numbers of trees are weakened across a landscape, western pine beetle populations may increase and kill hundreds of thousands of trees.

In 2015, a total of 467 acres were affected, mostly in Garfield, Kane and San Juan counties.

Much of this mortality occurred on the Powell and Escalante Ranger Districts.

- On the Powell RD; mortality was widely scattered, small pockets of trees (1 to 14 trees) across the southern portion of the Paunsaugunt Plateau. The greatest concentrations of pockets were detected in small drainages running into the East Fork of the Sevier River south of Tropic Reservoir (Upper Kanab Creek, Blubber Creek, Skunk Creek) and in the upper reaches of Podunk Creek. Six isolated pockets were also detected on the southern end of the Sevier Plateau.

- On the Escalate RD; morality occurred in small (1 to 4 trees), isolated pockets that were concentrated in the vicinities of Canaan Peak (upper reach of South Hollow in the far southeastern corner of the District), Bear Hollow, in the vicinities of Hog Ranch Spring and Buck Hollow, and in the Pockets area along western slopes of Escalante Mountain. A 50-tree polygon was mapped in upper reaches of Center Creek east of Osiris. Two 20-tree pockets were mapped in the upper reaches of Horse Canyon.

Roundheaded Pine Beetle

Dendroctonus adjunctus Blandford

Host: ponderosa pine

Roundheaded pine beetle has periodic outbreaks that kill thousands of pine trees, but more commonly this beetle subsists in small groups of weaker trees, often in conjunction with other bark beetles (western pine beetle, mountain pine beetle or pine engravers). Roundheaded pine beetle may attack trees of any size, but usually trees greater than 20 inches diameter at breast height.

No mortality attributed to roundheaded pine beetle was observed by ADS in 2015. However, it is possible that this beetle contributed to the ponderosa pine mortality accredited to the Western Pine beetle.

Borers

Pitch Mass Borer

Dioryctria spp.

Hosts: piñon pine, ponderosa pine, lodgepole pine, Austrian pine, Scots pine, and occasionally Douglas-fir and true firs

In urban areas, Scots/Scotch (*Pinus sylvestris*), Austrian (*Pinus nigra*), and Ponderosa pine (*Pinus ponderosae*), have been reported damaged by this insect. New or continued infestations have been seen yearly, since 2010.

Figure 4. Pitch mass borer (Photo Eric R. Day, Bugwood.org).

Pitch mass borer attacks appear as large, oozing masses of soft, light-pink sap that forms in response to larval feeding beneath the bark. Repeated attacks can seriously weaken trees and kill branches. Heavily damaged branches and trunks are often more susceptible to breakage. The most severe damage is usually to trees less than 20 feet tall, though pitch mass borer has been attacking larger trees in the urban landscape.

Pitch mass borer may be attracted to trees that are under stress due to; drought, over-irrigation, soil compaction, root injury, improper pruning cuts, mechanical damage, or other injuries. Infested trees may also be more susceptible to attack by black pineleaf scale or pine engraver beetle. Damage is still occurring in the urban setting in 2015.

Insects: Non-native

European Gypsy Moth (GM)

Lymantria dispar

Hosts: various deciduous tree species

Since the late 1800's, gypsy moth caterpillars have defoliated millions of acres in the northeastern United States. The gypsy moth feeds on over 250 deciduous tree species and infestations can build rapidly causing widespread defoliation. Tree mortality may occur after successive years of heavy defoliation. Infested areas may be subject to quarantine to prevent the spread of the insect. The caterpillars can also be a nuisance to homeowners by crawling over homes, vehicles, and outdoor furniture. Hairs found on the caterpillars can also cause allergic reactions in some individuals.

The gypsy moth was first detected in Utah in 1988 at Mount Olympus Cove, Salt Lake County. Being notorious hitchhikers they were probably transported into Utah from an infested area in the eastern U.S. Since then, the Utah Department of Agriculture and Food in cooperation with two USDA agencies, the Animal Plant Health Inspection Service and the United States Forest Service, place detection traps throughout the state using the GMWest model BioSIM to determine areas of highest risk of introduction and establishment. This model integrates climate and elevation data to

predict the probability of GM establishment. Eradication treatments have been used to treat over 73,000 acres since 1989. No aerial application projects have been conducted since 1999 within the state and no GM have been caught in traps since 2008.

The 2015 Utah Gypsy Moth Program placed 1,907 detection traps throughout the state, with no gypsy moths caught.

Emerald ash borer (EAB)

Agrilus planipennis

EAB is native to Asia, and was introduced through wood packing material used to ship cargo from Asia to Michigan in 2002. EAB continues to spread rapidly to states and provinces in and around the Great Lakes region in Canada and the USA. EAB quickly killed many millions of ash trees (*Fraxinus sp.*) in these areas, and can now be easily spread from infested areas by transporting infested trees and logs (especially firewood). In its native ecosystem, this insect exists in balance with competitors, natural predators, and pathogens. It does not cause economic damage in this setting. However, in North America, without these balancing factors, EAB has caused rapid tree mortality affecting all ash species it attacks. Symptoms of infestation begin with crown dieback, which is followed by epicormic shoots, splitting bark, increased woodpecker damage, serpentine galleries, and D-shaped exit holes. These symptoms progress until the tree is dead. In addition to Utah's many ornamental ash trees in urban landscapes, there are two native ash species that are part of the forest ecosystem. All of these species would be vulnerable to EAB attack, causing economic and aesthetic losses in urban areas and ecological impacts in natural settings.

Figure 5. Emerald ash borer adult. bugwood.org

In 2015, APHIS PPQ placed 105 baited traps throughout eight counties, targeting high-risk ash trees that exhibited symptoms associated with unhealthy or declining trees. No EAB were detected from these efforts. (*2015 Plant Industry and Conservation Insect Report.* http://ag.utah.gov/documents/2015InsectReport.pdf)

DISEASE STATUS

Stem and Branch Diseases

Dwarf Mistletoes

Arceuthobium spp.

Hosts: Douglas-fir, pines, and true first

Dwarf mistletoes (DM) are the single most damaging agent of coniferous trees. These parasitic plants remain the most widespread and frequently

Figure 6. Southwestern dwarf mistletoe (Photo: John Guyon; FHP, OFO).

observed disease within the state. Profusely branched, dense masses of host branches called "witches brooms" are typically observed in infected trees. Heavy dwarf mistletoe infections can predispose trees to insects and other diseases, reduce incremental growth, affect the forest canopy structure, lower resistance to drought, and influence wildlife habitat, recreation and aesthetics. Since dwarf mistletoe infects trees of all ages, infection may exist in secondary growth and regeneration, as well as young and old forests.

Piñon Blister Rust

Cronartium occidentale

Hosts: Colorado and singleleaf piñon

This native rust causes stem rust cankers and branch flagging on both Colorado piñon and singleleaf piñon in Utah. This disease kills small trees. These rust infections are commonly associated with attacks by the pitch mass borer and tend to be located near streams and wet areas where the alternate host (primarily *Ribes spp*, currants and gooseberries) are located.

Root Diseases

When present, root diseases spread from the roots of one tree to another, and to a limited extent through the soil. Root diseases are often called "diseases of the site", indicating that once present in a forest they tend to persist throughout the entire lifespan of the trees on that site. Susceptibility of the trees and virulence of the pathogens involved varies from one area to another. In Utah, root diseases are less damaging than in other areas with moister climates and forests that have been impacted by exotic pathogens. True "root disease centers", areas with a high concentration of root disease, are rare in the state. More commonly, evidence of root disease is scattered throughout many forests, with varying degrees of impact. Root diseases are intimately involved with populations of bark beetles, with endemic bark beetle populations often associated with root disease centers.

Several tree conditions are symptomatic of all root diseases. The symptoms can vary if trees are killed rapidly or with size of the tree. The foliage of small trees that have been killed rapidly often turns red. On older trees many of these agents can act as butt or root decays without killing the tree. Trees that have a portion of their root system impacted by root diseases often exhibit several symptoms, including; thinning in the crown from the lowest part towards the highest, and from older foliage towards the younger. In general, the production of conspicuous fruiting bodies of root diseases is rare in Utah, occurring most often in relatively moist years. Several of these diseases can also act as saprophytes, which induce decaying of dead material.

Annosum Root Disease

Heterobasidion annosum

Hosts: Douglas-fir, pines, spruce, and subalpine fir

This disease can be found throughout the state, but frequently acts as butt decay or as a saprophyte on dead trees, stumps, and roots. It occurs in trees of all ages. The symptoms on larger trees include a thinning crown

Figure 7. Annosum conk at the base of a tree (Photo: John Guyon; FHP, OFO)

and fruiting bodies or conks that develop in decayed stumps and roots. The conks are woody to leathery with a dark brown upper surface and cream colored pore surface (Figure 7). Advanced decay in the root tissues looks white, stringy, and somewhat laminate.

Armillaria Root Disease

Armillaria spp.

Hosts: Douglas-fir, Engelmann spruce, subalpine fir, white fir, and pines

Evidence of Armillaria root disease can be found throughout the state. It often functions as a weak parasite killing trees experiencing environmental stress. In southern Utah, it may act as a primary pathogen killing mature and immature ponderosa pine and mature fir and spruce on cool sites at higher elevations. It often acts as a thinning agent in young stands or in areas with shallow, poor soils. Symptoms of Armillaria include heavy resinosis at the root collar, and thick fan-shaped mats of white fungus tissue under the bark where root and root collar tissue are dying (Figure 8). The fungus produces rhizomorphs that resemble black string-like structures that can move through the soil a few feet to infect other roots. When present, Armillaria mushrooms grow in clusters from the roots or at the base of the tree. The decay caused by the fungus is yellowish and stringy/spongy and often contains black lines called zone lines.

Figure 8. Armillaria fans on Ashley National Forest (Photo: John Guyon; FHP, OFO).

Black Stain Root Disease

Leptographium wageneri

Host: Colorado and singleleaf piñon pine

Black stain root disease is an important disease of several hosts, but it is only found on piñon pine in Utah. It usually kills infected trees within a few years, and can result in groups of tree mortality several acres in size. Pockets of infected trees are preferred hosts for low-level populations of piñon engraver beetles (*Ips confusus*). No new pockets of black stain root disease were observed by aerial survey in 2015.

Leaf and Needle Diseases

Aspen Leaf Spot

Marssonina populi

Host: aspen

Aspen leaf spot is the most common leaf disease of aspen in the West. Severe outbreaks may cause foliar browning in midsummer and nearly complete defoliation by early August. Re-growth usually follows in late summer and early autumn. Symptoms include small brownish spots on infected leaves in mid- to late-summer. The spots later enlarge and turn black in color. They will vary in size and appear irregular in shape with a yellowish border (Figure 9). Blight and leaf spot caused by this disease have been seen in the past throughout the host type, and although not indicated on ADS maps, it is likely a contributing factor to aspen dieback and decline.

Figure 9. Symptoms of aspen leaf spot.

In 2015, spring weather conditions were very favorable for aspen leaf spot. ADS mapped 15,228 acres affected by this disease. This number is likely lower than the actual acres as sometimes it is difficult to discern foliar damage from the air. Symptoms and early defoliation associated with this disease was noted statewide, especially, in high elevations sites.

DECLINES / COMPLEXES

Subalpine Fir Mortality Complex

Host: subalpine fir

The western balsam bark beetle (WBBB) is the most significant mortality agent in a complex of forest insects and diseases causing subalpine fir mortality. Endemic populations will occur in storm-damaged trees, slash, or trees of poor vigor. WBBB infestations may build to epidemic levels where mortality can occur in groups of 100 to 10,000 trees. Annosum root disease, woodborers, and several species of smaller bark beetles are also involved in this complex. Environmental stress, due to drought or overcrowding, may also have a role in the death of trees in this category.

In 2015, the total acreage of subalpine fir affected by this mortality complex increased slightly from 2014 (23,211 acres) to 25,005 acres. Only Rich, Sanpete, and Wayne counties had no mortality reported.

Aspen Decline

Host: aspen

Aspen dieback/decline mapped by aerial detection survey increased 29% in 2015 from 2014 numbers, yet remained at low levels compared to the peak in aspen dieback/decline recorded from 2006 through 2008. Aspen dieback/decline has been attributed to a complex of agents including drought, grazing, poplar borer (*Saperda calcarata*), bronze poplar borer (*Agrilus liragus*), Cytospora canker (*Valsa sordida*) and sooty bark canker (*Encoelia pruinosa*). The borers and Cytospora canker disease agents are commonly considered secondary pests. Sooty bark canker is usually considered a disease of older stands.

In recent years, aspen bark beetles (*Trypophloeus populi* and *Procryphalus mucronatus*) have been associated with damage. Aspen bark beetles are now common in many Utah stands with dieback and decline symptoms. Field observations indicate that *Trypophloeus* attack trees that still have a large component of "green bark", while *Procryphalus* is found in trees in which the bark is almost entirely dead. Aspen mortality caused by bark beetles, borers, and canker diseases increased as a result of significant drought periods during the last decade. Collectively, this suite of damaging agents is associated with stressed, older aspen with high rates of mortality and regeneration damage from grazing pressure. In most of the Intermountain Region, aspen stands have at least some suckering and do not have the symptoms of sudden aspen decline reported in other Regions

ABIOTIC DAMAGE

Frost Damage

Hosts: maple, gambel oak, aspen, all conifers can be affected but, Douglas-fir, and spruce are more susceptible

Freeze damage occurs when temperatures drop 2˚ to 5˚ below freezing after tree growth has started in the spring. The young branch tips of trees affected by freeze damage droop, and turn brown, and new shoots or needles of breaking buds are killed. This damage may result in branch dieback, stunted growth, and poor tree form.

There was no frost damage mapped in Utah in 2015.

Blowdown

Areas of concentrated, high velocity winds can cause trees to blow over often referred to as blowdown. Blowdown occurs in groups or as scattered trees within the landscape. Depending on the tree species, patches of blowdown in coniferous forests can provide a food source for various bark beetles enabling populations to build to epidemic levels. Epidemic beetle populations may then attack and kill standing live trees, most often adjacent to the blowdown.

In 2015, blowdown was mapped in Summit and Carbon counties, 606 acres and 473 acres respectively.

Snow Avalanches/Mudslides

Like blowdown damage, snow avalanches and mudslides knock down trees and may provide an abundant, local food source for certain bark beetles, enabling populations to build.

There were no avalanches or mudslides mapped in Utah in 2015

Drought

Drought can influence insect and disease activity. Drought- related damage was not mapped in 2015.

NOXIOUS WEEDS

Noxious weeds are a continuing problem for all Western states. They have the ability to aggressively colonize disturbed habitats thus displacing native plant species and altering ecosystems. Several state and federal agencies have the responsibility for monitoring and controlling noxious weeds. As of 2015, approximately 338 species of exotic aquatic and terrestrial

plants infest lands in the State of Utah (EDDMapS- Early Detection & Distribution Mapping System-University of Georgia, Center for Invasive Species and Ecosystem Health). Utah has declared 27 of these species as noxious weeds. Noxious weeds are grouped into one of three classes, depending upon their management priority. "Class A" weeds have a relatively low population size within the State and are of highest priority being an Early Detection Rapid Response (EDRR) weed. "Class B" weeds have a moderate population throughout the State and generally are thought to be controllable in most areas. "Class C" weeds are found extensively in the State and are thought to be beyond control. Statewide efforts would generally be towards containment of smaller infestations. Most counties in Utah have listed additional noxious weeds that are of local concern.

- Class A weeds include; spotted knapweed, leafy spurge, black henbane, medusahead, Oxeye daisy, sulphur cinquefoil, Johnsongrass, purple loosestrife, yellow starthistle, leafy spurge, St. Johnswort, yellow toadflax, and diffuse knapweed.

- Class B weeds include; Bermudagrass, hoary cress, musk thistle, perennial pepperweed, Russian knapweed, Scotch thistle, Dalmation toadflax, dyer's woad, and poison hemlock.

- Class C weeds include; quackgrass, houndstongue, field bindweed, Canada thistle, and saltcedar. The exact acreage of lands infested by these noxious weeds in each county is unknown, however,

For more up-to-date information on Utah Noxious Weeds go to: **http://www.utahweed.org**

The following noxious weed websites, while not inclusive, give additional information on noxious weeds; such as biology, history, and control.

http://www.invasivespeciesinfo.gov/
This website is the gateway to federal, state, local, and international efforts concerning invasive species.

http://www.ipm.ucdavis.edu
University of California integrated pest management website has information on how to identify and manage pests, educational resources, and research information.

http://invader.dbs.umt.edu
The University of Montana's INVADERS Database is a comprehensive database of exotic plant names and weed distribution records for five states in the northwestern United States. It is used as a search engine that links the user to informational websites on most of the invasive weeds. You can search the database for the list of noxious weeds by state and most identified plants have additional information and links to more information.

https://www.cdfa.ca.gov/plant/ipc/encycloweedia/encycloweedia_hp.html
California Department of Food and Agriculture has a very comprehensive website. Information includes description, biology, distribution, habitat, and management of plants and control methods. Pictures of the plants in various stages are just a click away.

http://www.nwcb.wa.gov
State of Washington's noxious weed control board website has information on numerous weeds. Topics include identification, why it's a noxious weed, geographic distribution, reproduction, and control options such as mechanical, herbicide, cultural, and biocontrol potentials.

http://www.invasiveplantatlas.org
The Invasive Plant Atlas of the United States website is a collaborative project between the National Park Service, The University of Georgia Center for Invasive Species and Ecosystem Health, the Invasive Plant Atlas of New England, and the Lady Bird Johnson Wildflower Center, that assists users with identification, early detection, prevention, and management of invasive plants.

EDDMapS 2016- Early Detection and Distribution Mapping System. University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: **http://www.eddmaps.org/**.

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